

REMARKS

The rejections of Claims 1, 2, 4 and 5-7 under 35 U.S.C. § 102 (b) as anticipated by, and of Claims 3 and 8 as unpatentable over, U.S. 5,728,636 (Nawa et al), are respectfully traversed.

As recited in above-amended Claim 1, the invention is a  $\text{ZrO}_2$ - $\text{Al}_2\text{O}_3$  composite ceramic material produced by a process comprising mixing a first powder for providing  $\text{ZrO}_2$  grains with a second powder for providing  $\text{Al}_2\text{O}_3$  grains, which is obtained by mixing an  $\alpha$ - $\text{Al}_2\text{O}_3$  powder having an average particle size of  $0.3\ \mu\text{m}$  or less **with a  $\gamma$ - $\text{Al}_2\text{O}_3$  powder having a specific surface within a range of 10 to  $100\ \text{m}^2/\text{g}$  and a substantially spherical shape** prepared such that **a mixture ratio by volume of the  $\gamma$ - $\text{Al}_2\text{O}_3$  powder to the  $\alpha$ - $\text{Al}_2\text{O}_3$  powder is in a range of 50:50 to 90:10**, molding a resultant mixture in a desired shape to obtain a green compact, and sintering said green compact at a sintering temperature in an oxygen-containing atmosphere, wherein the composite ceramic material comprises a first phase of said  $\text{ZrO}_2$  grains containing 10 to 12 mol% of  $\text{CeO}_2$  as a stabilizer and having an average grain size of  $0.1\ \mu\text{m}$  to  $1\ \mu\text{m}$ , said  $\text{ZrO}_2$  grains composed of 90 vol% or more of tetragonal  $\text{ZrO}_2$ ; a second phase of said  $\text{Al}_2\text{O}_3$  grains having an average grain size of 0.1 to  $0.5\ \mu\text{m}$ , a content of said second phase in the composite ceramic material being within a range of 20 to 60 vol%; wherein said  $\text{Al}_2\text{O}_3$  grains are dispersed within said  $\text{ZrO}_2$  grains at a first dispersion ratio of 4% or more, which is defined as a ratio of the number of said  $\text{Al}_2\text{O}_3$  grains dispersed within said  $\text{ZrO}_2$  grains relative to the number of the entire  $\text{Al}_2\text{O}_3$  grains dispersed in the composite ceramic material, and said  $\text{ZrO}_2$  grains are dispersed within said  $\text{Al}_2\text{O}_3$  grains at a second dispersion ratio of 1% or more, which is defined as a ratio of the number of said  $\text{ZrO}_2$  grains dispersed within said  $\text{Al}_2\text{O}_3$  grains relative to the number of the entire  $\text{ZrO}_2$  grains dispersed in the composite ceramic material. (Emphasis added.)

Method Claim 4 contains the above-emphasized features as well.

Nawa et al neither discloses nor suggests the above-emphasized features, nor the superior results obtained when the above-emphasized mixture ratio is within the recited range. Indeed, Nawa et al actually teaches away from various aspects of the present invention, as now discussed.

While Nawa et al discloses a  $\text{ZrO}_2\text{-Al}_2\text{O}_3$  composite ceramic material, Nawa et al neither discloses nor suggests the use of a  $\gamma\text{-Al}_2\text{O}_3$  powder having the presently-recited specific surface within a range of  $10\text{-}100\text{ m}^2/\text{g}$  and a substantially spherical shape, let alone any mixtures of a  $\gamma\text{-Al}_2\text{O}_3$  powder and an  $\alpha\text{-Al}_2\text{O}_3$  powder. Rather, Nawa et al discloses using an  $\alpha\text{-Al}_2\text{O}_3$  powder, or a powder of  $\gamma\text{-Al}_2\text{O}_3$  having a specific surface area of  $100\text{ m}^2/\text{g}$  or more (paragraph bridging columns 5 and 6; emphasis added). An  $\gamma\text{-Al}_2\text{O}_3$  having a specific surface area of  $100\text{ m}^2/\text{g}$  or more has a needle-like shape. As compared with such a bulky  $\gamma\text{-Al}_2\text{O}_3$  powder as disclosed by Nawa et al, Applicants describe in the specification herein beginning at page 11, line 20 that using the presently-recited  $\gamma\text{-Al}_2\text{O}_3$  powder results in such advantages as improved formability, easy controllability of the average grain size of the second phase within the range of  $0.1\text{ }\mu\text{m}$  to  $0.5\text{ }\mu\text{m}$ , and the possibility of obtaining a mutual nano-composite structure having increased first and second dispersion ratios. Nor does Nawa et al recognize the advantage of using a mixture of  $\gamma\text{-Al}_2\text{O}_3$  powder and  $\alpha\text{-Al}_2\text{O}_3$  powder, compared to the use of  $\gamma\text{-Al}_2\text{O}_3$  powder alone, which advantage is that the mutual nano-composite structure of the composite ceramic material is easily formed at increased first and second dispersion ratios, as described in the specification herein at page 12, lines 11-14.

While the above is sufficient to distinguish the presently-claimed invention from Nawa et al, the comparative data in the specification herein further support patentability, in that it demonstrates the superiority of the presently-recited mixture ratio range of  $\gamma\text{-Al}_2\text{O}_3$  powder to  $\alpha\text{-Al}_2\text{O}_3$  powder.

As described at page 12, lines 15-24 of the specification herein, when the amount of the  $\alpha$ - $\text{Al}_2\text{O}_3$  powder is 50% or less with respect to the total volume of the second powder, it is possible to obtain the mutual nano-composite structure having **increased first and second dispersion ratios**. As the additive amount of the  $\alpha$ - $\text{Al}_2\text{O}_3$  powder becomes more than 50 vol%, there is a tendency that **the first dispersion ratio gradually decreases**. In addition, when  $\alpha$ - $\text{Al}_2\text{O}_3$  powder is not used, i.e., only  $\gamma$ - $\text{Al}_2\text{O}_3$  powder is used, it is necessary to perform a calcining step prior to the subsequent sintering step to obtain a highly improved mechanical strength of the composite ceramic material. Indeed, a comparison between Examples 21 and 27 herein shows that bending strength deteriorates considerably in the absence of the calcining step. On the other hand, from a comparison between Examples 24-26 and Examples 30-32, i.e., when the amount of the  $\alpha$ - $\text{Al}_2\text{O}_3$  powder is 30 vol% or more, it can be seen that a sufficiently high bending strength of the composite ceramic material is obtained without performing a calcining step. Thus, according to the present invention, it is possible to provide the advantages of more reliably achieving a first dispersion ratio of **4% or more**, as compared to the composite ceramic material of Nawa et al, thus obtaining a remarkably improved bending strength of the composite ceramic material.

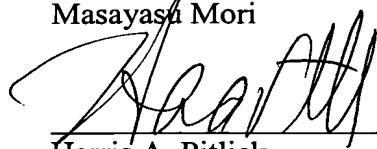
For all the above reasons, it is respectfully requested that the rejections over Nawa et al be withdrawn.

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All of the presently pending claims in this application are now believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

Respectfully submitted,

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